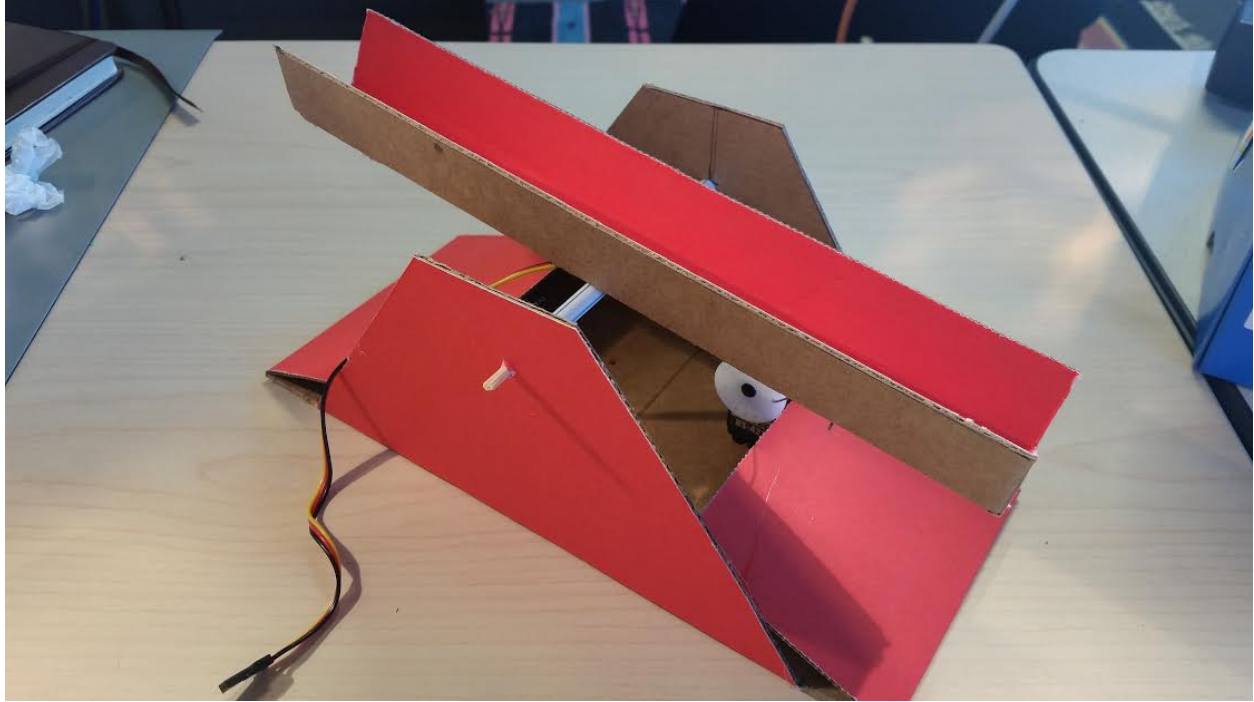




## Balance Beam: Instructor Guide



### Day/ Night Before

- 1) **Volunteers:** Contact your teacher and get a final headcount, time and location of your workshop as well as any last minute information they may have for you.
- 2) If the classroom set is on a checkout system or a classroom cart be sure to get this into your possession.
- 3) Check each kit to be sure all components, Galileos and Power supplies are accounted for. Here is a wish list of what each kit should include: <http://sfe.io/w91575>
- 4) If a kit is missing parts, take note of which parts are missing for reorder and resupply.
- 5) Double check the MicroSD card in each Galileo.
  - a) Power each Galileo and make sure it broadcasts a wifi network. (This is roughly 2 minutes per Galileo.)
- 6) Collect a placemat and reference card set for each kit.
  - a) These may need to be printed!
- 7) Double check presentation materials for the workshop and print out Expansion Handouts for the total number of students you will work with.
- 8) Collect all required extension cords, power strips and extra parts. (LEDs, standoffs, screws, extra antennas and jumper wires are recommended to have on hand at all times.)
- 9) Collect any collateral you want to give out to participants.

## **1 Hour Before**

1. Arrive at workshop location. If at a school be sure to check-in with the front desk and get a name tag.
2. Find location you will be teaching
3. Setup
  - a. Each station will be occupied by 2 students. Make sure that each station has 2 chairs.
  - b. Each station should be set according to this photograph.  
(photo of workshop station)
  - c. Run required power to all stations. Each station will require at least one outlet, more if you plan on using laptops.
    - i. Be sure to tape down any wires that pose a tripping hazard
  - d. Setup your instructor station with projector, laptop and instructor Galileo
    - i. Double check that all participants can view the projector clearly
    - ii. Open presentation slide deck and have it on the cover slide before students arrive.
4. Hit the restroom before students arrive!
5. Have collateral ready to give out, have a plan for rewarding students ahead of time.
6. Have the instructor Galileo powered up and make sure it is functional.

## **Lesson Timing Guide**

*Arrange with the hosting teacher to have them take roll “on the fly” as the workshop will take all of the time allotted.*

### **Introductions (5 Minutes)**

- Warm-up question: What does mechatronics mean to you? Take a guess...what does “mecha” mean and “tronics” mean?
  - Have students share with their elbow buddies
  - Call on 2-3 students to share their partners’ answer

### **Re-Introduce CAT (5 Minutes)**

- Connect AnyThing
  - Tried to make it like LEGOs for Electrical Engineering
- Galileo is a small computer that you can hook up inputs and outputs to and then connect them.
- Use it to control a project without a sensor using **Controller Mode**
- Handout student guide packets

### **What is a Servo (5 Minutes)**

- Servo motors are motors that are programmable to rotate to a given angle
  - compare a servo to a standard motor.
    - Standard Motor continuous rotation, servo 0-180 degrees
    - Standard Motor is 2 wires (5V and GND)

- Servo is 3 wires (5V, GND and SIG)
- Servo motors are controlled by the Analog output pins (~)
  - Hook up a servo to pin 9
    - demonstrate hooking up a servo with wire direction

#### Controller Mode

- Once the servo is hooked up demonstrate the following
  - adding pin 9 as an output
  - making sure that it is set to servo
  - controlling a servo

#### Set the Stage for the Project (5 Minutes)

- They have created the “guts” of a mechatronics control system. All it needs now is to have something to move...an automated balance beam!
  - Go over materials and tools available to the students
  - Note that the project has cutting templates
    - each student pair should have a template and enough cardboard to create a balance beam
- ***Review safety information about using craft razor blades***
- To have the servo control the beam students will need to build a linkage out of a paper clip
  - example image in their packet

#### Project work Time (20 Minutes )

- Student workflow should be as follows over the course of 2 days
  - 1 cutting out and tracing cutting templates
  - score all bent joints (dotted lines on the templates) and bend.
  - Glue parts together
    - See student guide
  - Bend paperclip into linkage
  - Glue servo in place and connect linkage
  - create control system with Controller Mode
- Extension activities
  - Adding a sensor to control their balance beam accurately.
    - how long can you keep a marble on your beam?
  - Create a multiple beam “pass off” game
    - students group together to pass a marble from one beam to another.
  - What else could you use a servo for...?
    - Using materials students could build their own mechatronic device

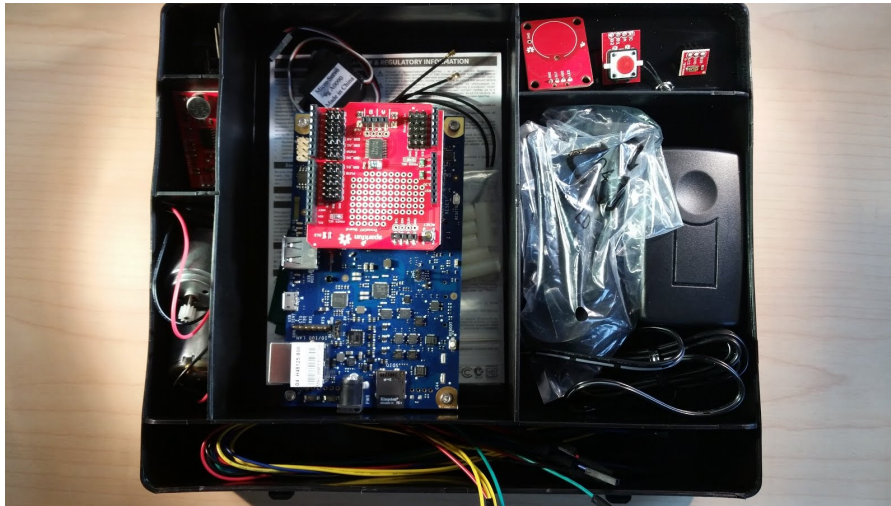
#### Cleanup and debrief each day(10 Minutes)

- When it is time to clean up
  - Students return all tools to specified area
  - Have host teacher walk around with recycling bin while you lead debrief
- Debrief
  - When is it a good time to use a servo vs. a normal motor?

- Do you know of an application point in your house or the classroom?
- What would you do if you had more than one servo?

## **Follow-up and Post Workshop**

- Unplug all of the Galileos
  - pull up and dispose of tape.
- repack kits, take note that all sensors and actuators are in tact
  - If something is missing, take note of it for restocking
  - Replace all parts in the kit so it reflects this image...



- Thank the teacher for hosting and for any feedback on your instruction
  - They are experts at what you just did, take their feedback to heart!
- Leave the follow-up packet and going further packets for the students
  - The host teacher should go over it with the students the next day.
  - Let the teacher know you can return for a 2nd Intel lead workshop
- Make sure you can everything the way you found it
  - take all hardware you brought!
  - offer to put up the chairs in the room for the teacher

## **Clean Up and Repacking**

- Upon return put the set of kits back and inform the person in charge of them of any malfunctions, missing parts, etc.
- Send a thank you email to host teacher!